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SANITARY ASPECT OF THE WATER SUPPLIES AT THE ARMY CANTONMENTS¹

BY LIEUTENANT-COLONEL JAMES T. B. BOWLES, N.A.

One of the duties of the Sanitary Corps has been the supervision of the quality of water supplies at the various cantonments.

The water requirements of the cantonments, both from the standpoint of quality and quantity, have been anticipated by the Cantonment Division of the Quartermaster Corps remarkably well. No source has been so inadequate that there was such danger of shortage that it had to be supplemented by additional sources;—no source was questionable from the sanitary standpoint to the extent that its use was prejudicial to health.

In the development of the water supplies, purity was not lost sight of. Construction Quartermasters at the various cantonments were given blanket authority to purchase chlorinators. This was done in practically all cases, either one or more chlorinators being installed.

The development of supplies for the cantonments has been along the following lines:

(a) Purchase of water from municipalities where the camp was located within a reasonable distance from city and where the municipal plant had facilities to assume the additional load.

(b) Development of a special supply,—a ground water supply where there was knowledge of water bearing strata, and where the cost of obtaining it was not prohibitive.

(c) Lastly, development of surface supplies, supplemented by a purification process where necessary.

Of 31 National Army and National Guard camps, 18 are supplied with water from municipal systems. Twelve of these are surface

¹ "Permission to publish the inclosed article, entitled 'Sanitary Aspect of the Water Supplies at the Army Cantonments,' by Lieutenant Colonel James T. B. Bowles, is granted as requested.

"By direction of the Surgeon General:

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supplies, demanding such purification as will insure at all times a clear, colorless and sanitary water. Six are ground waters, requiring no purification, with possible exception of chlorination more as a prophylactic than a necessity. Most of these municipal systems have been found amply large enough to assume the demands of additional consumption without increased plant development.

Fourteen supplies were developed by the Cantonment Division; only three of these were surface supplies.

One of these surface supplies utilizes water from a sparsely inhabited water shed, and as a sanitary precaution no other purification is necessary than chlorination. The other two are from polluted streams and require purification.

Of the ground water supplies developed, none required purification other than chlorination.

In the case of the western camps, where ground waters are used, softening for boiler and laundry purposes has been considered advantageous.

Supervision of quality of water has been conducted on the following lines:

- (a) Inspection of municipal plants.
- (b) Arrangements whereby frequent bacteriological examinations of all sources could be made.

The inspection of municipal plants revealed many interesting conditions. In many cases a modern up-to-date plant, supervised by live officials with a sense of the necessity of pure and wholesome water; but in too many cases, plants operating with a low margin of safety, and under the control of operators who had little knowledge of the kind of water the plant was turning out.

The inspection resulted in either assisting the city to secure competent men to supervise operation or to make arrangements whereby an officer of the Sanitary Corps would assume responsibility for the quality of the water.

Some authorities gladly and willingly coöperated in carrying out the improvements and changes recommended. Others reluctantly admitted that the quality of their water supply was not above suspicion. This latter class was usually the short-visioned, non-informed type of citizen, whose ideal of the best fulfillment of his position was in keeping a tight clutch on the purse-strings.

From the beginning of the cantonment activities, an effort was made to secure accurate bacteriological data concerning the various

Water supplies at national guard camps

CAMP	MUNICIPAL SUPPLY	DEVELOPED BY CANTON- MENT DIVISION	CHARACTER			PURIFICATION PROCESS						REMARKS	
			Ground water	Surface water		Plain sediments-	Chemical treat-	Coagulation	Filtration		Chlorination		
				Impounding reservoir	River				Pressure fil- ters	Mechanical gravity	Liquid chlorine		Hypochlo- rite
Beauregard.....	yes	yes	yes	yes*		yes	yes		yes	yes			* West Fork, Trinity River. Water slightly hard at times. Considerable turbidity
Bowie.....													Unquestionable purity. Fairly hard. Artesian wells
Cody.....	yes		yes	yes*		yes ¹			yes	yes			* Lake Lawtonka. Trouble from heavy algal growths
Doniphan.....	yes				yes	yes	yes	yes	yes	yes	yes		Catawba River. Soft water. Considerable turbidity at times
Greene.....	yes				yes	yes	yes	yes ²		yes	yes		Savannah River. Soft water. High turbidity at times
Hancock.....	yes				yes	yes	yes	yes		yes	yes		San Diego River. Soft water, slightly colored, variable turbidity
Kearny ³	yes				yes	yes	yes	yes					
Logan.....		yes	yes										
McArthur.....	yes		yes	1*		yes	yes	yes	yes	yes	yes		* Brazos River. Treatment applies to river water only

McClellan.....	yes		yes*		yes ⁴	yes	yes	* Source, mountain springs.
Sevier.....	yes		yes					
Shelby.....	yes	yes	yes*					* Artesian wells
Sheridan.....	yes		yes	yes	yes	yes	yes	* Stone creek
Wadsworth.....	yes	yes ⁵	yes*	yes	yes	yes	yes ⁶	* Ocmulgee River
Wheeler.....	yes		yes*	yes	yes	yes	yes	

¹ Copper sulphate twice monthly.

² Alum applied to water entering sedimentation basins, during high turbidity.

³ Artesian wells in River Bed, used as emergency supply.

⁴ About one-third of water from an isolated reservoir, treated with alum and passed through pressure filters.

⁵ An emergency supply and used until camp had been connected to city mains.

⁶ City water is chlorinated before entering camp distribution system.

Water supplies at national army camps

NAME OF CAMP	MUNICIPAL SUPPLY		DEVELOPED BY CANTON- MENT DIVISION		CHARACTER OF SUPPLY			PURIFICATION PROCESS						REMARKS
	Ground water	Surface water		Coagulation	Chemical treat- ment	Filtration	Chlorination							
		Impounding reservoir	River				Pressure fil- ters	Mechanical gravity	Liquid chlorine	Hypochlo- rite				
Custer.....			yes	yes		yes ¹			yes	yes ²		A relatively hard water, 250 p.p.m. CaCO ₃ . Unquestionable purity		
Devens.....			yes	yes					yes			Water has been exceptionally good despite evidences of pollution		
Dix.....			yes		yes*							* Rancocas Creek. Highly colored, high free CO ₂ free vegetable acid in small amounts		
Dodge.....			yes	yes					yes			A hard water. Original purity unquestionable		
Funston.....			yes	yes		yes ⁵	yes	yes	yes			A relatively hard water		
Gordon.....	yes				yes*	yes						* Chattahoochee River. A soft water highly turbid at times		
Grant.....			yes	yes					yes			A hard water. All boiler water softened		
Jackson.....	yes				yes*	yes	yes ⁵	yes	yes			* Congaree River. A soft water, highly turbid at times. Polluted		
Lee.....	yes				yes*	yes	yes ⁵	yes	yes			* Appomattox River. A soft water, highly turbid at times. Polluted		

Lewis.....	yes		yes*		yes ^b	yes	yes		* Little Patuxent River. A soft water. High turbidity, varying with rainfall. Relatively polluted
Meade.....	yes								
Pike.....	yes		yes**	yes	yes ^c	yes	yes ^d	yes	* Arkansas River. A very turbid water, and relatively hard at times. Polluted
Sherman.....								yes	
Taylor.....	yes		yes*	yes	yes ^e	yes	yes	yes	* Ohio River. A soft water, highly turbid at times. Polluted
Travis.....									
Upton.....	yes							yes	

¹ Water for all heating systems and laundry softened.

² For emergency use. During winter several breaks occurred in well casing.

* Artesian well water used when chlorine in river water goes above 400 p.p.m.

⁴ About four-fifths of the plant is pressure filters.

Alum and lime treatment.

Iron and lime treatment.

supplies. Prior to any definite knowledge of the potability of these supplies, it was assumed that they were all more or less polluted, or at least there was potential pollution and facilities for chlorination were installed.

In this the department had the coöperation of the manufacturers of the apparatus for applying liquid chlorine, who gave prior consideration to all Government orders. Analyses were made at the Army Medical School, Washington, D. C., and the Departmental Laboratories of the U. S. A.; by the Red Cross Units and the Public Health Service, and at the base hospital laboratories connected with the various camp hospitals.

In the early period of the camps, semi-weekly samples were collected and forwarded by express or mail to the nearest Government laboratory. Where the results of the analyses showed contamination, the camps were immediately informed by telegraph. The means of protection was chlorination, and where this was not possible an order was issued to boil all drinking water.

In the extra-cantonment areas, the U. S. Public Health Service included examination of water supplies in their routine work. This was of great assistance in checking up the operation of municipal supplies. A great many of these municipalities had no analytical data on their water supplies; furthermore there seemed to be no tendency on the part of the various State Boards of Health to exercise supervision or control. Where analytical data were available the interpretation corresponded to numerous and varied standards.

The standard of the Treasury Department as applied to interstate carriers was early adopted as the standard of water supplied to the cantonments.

In the early period of the camps, considerable apprehension was caused by the results of the analytical tests, which in many cases indicated gross pollution. This could be accounted for only as a result of construction. This pollution was in most cases temporary and gradually disappeared with continued use of wells and distribution systems.

Since the base hospital laboratories have been equipped, bacteriological analyses of water are now a part of the daily routine.

The results of sanitary water and typhoid prophylaxis have resulted in a remarkably small number of cases of typhoid and related diseases among the troops at the camps. From September 14 to

April 26, there have been 123 cases of typhoid with seven deaths, 315 cases of dysentery with one death.

What quota of these cases is attributable to water it is impossible to say.

Several of the typhoid cases developed in the early part of September and may have had their origin in civilian communities.

In conclusion the author would state that liberal application of chlorine, with close laboratory control and supervision, has resulted in a pure and wholesome water being supplied to the camps at all times.